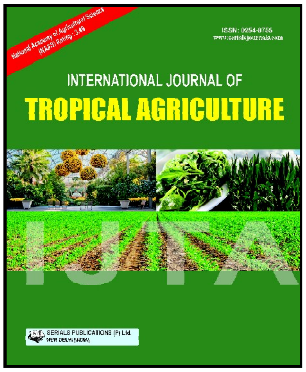

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Effect of Non Genetic Factors on Reproduction Traits of Gir Crossbred

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Abstarct: The data for the present investigations were collected from the history and pedigree sheets maintained at Research Cum Development Project on Cattle, M.P.K.V., Rahuri, (MS), for the period of 40 years (1972 to 2011) on reproduction and production traits of Gir halfbreds, triple cross and their *Interse*.

The data were classified according to genetic group, season of birth/calving, period of birth/calving and lactation order. In order to overcome non-orthogonality of the data due to unequal subclass frequencies, least squares techniques (Harvey, 1990) was used to estimate the effect of different factors using different Effect of genetic and non-genetic factors . The results obtained in the present investigation of the overall least squares means of AFS in FG and FJG were 455.95 ± 6.91 and 496.72 ± 5.08 days while in *Interse* of FG and FJG were 638.99 ± 8.31 and 660.31 ± 8.86 days, respectively. The DMRT revealed that the POB (1975-1977) had significantly lower AFS in FJG group. In *Interse* of FG cows born during period 2004-2009 had lowest AFS which was at par with the period 1980-1982 and significantly differed than rest of the period. Cows of AFS of cows born during *Interse* of FJG group the AFS of cow born during period 1983-1988 had significantly lower AFS followed by cows born during the period 1977-1982, 1989-1994, 2007-2011, 1995-2000 and 2001-2006. The season of birth had non-significant effect on AFS in all genetic groups. The generation had significant ($P<0.01$) effect on AFS. The overall mean AFS as affected by generation was 628.91 ± 6.09 days in FG and 645.81 ± 5.18 days in FJG. The effect of genetic group on AFS was non-significant. However, the FG genetic group had lowest AFS. The overall least squares means of AFFS in F_1 cows of FG and FJG was 533.41 ± 6.37 and 538.82 ± 0.37 days, while in cows of *Interse* of FG and FJG it was 743.13 ± 10.72 and 760.44 ± 12.61 days, respectively.

Keywords: Reproduction traits, genetic, non-genetic factors.

INTRODUCTION

The economics of dairy Industry is based on productivity of the animals which is govern by several genetic and non-genetic factors. To exploit the genetic potential of the animals it is essential to know the contribution of non-genetic factors to enable them for exploitation. Comparative study is most essential to evaluate the genetic and non-genetic parameters which affect reproduction traits.

The crossbreeding programme is quickest way to bring about the improvement in economic traits of Dairy cattle. The crossing of non-descript indigenous cattle with exotic dairy breeds like Holstein, Jersey and Brown Swiss for high productivity has been the widely adopted policy in India. By crossbreeding, hybrid vigour and additive genetic potential of highly productive exotic breeds are exploited. Thus genetic improvement of livestock by cross breeding is relatively a worldwide accepted concept for enhancing their growth, production and reproduction performance.

Although exotic cattle and their crosses are being used increasingly to raise milk production in hot climate of Indian sub-continent, it is extremely difficult to predict which breed, cross or generation will give highest economic returns over investment, because of the wide variation in performance of crossbreds due to differences of exotic donor breed and adaptability of the crossbred to the divergent climatic conditions of the tropics (Patel and Dave, 1987). Hence, identification and stabilization of the optimum level of exotic inheritance is still moot point in the crossbreeding programme (Dalal *et al.*, 1991). It is very essential to assess the comparative performance of crossbreds of various generations under divergent agro climatic environment of formulation and implementation of long term breeding programmes (Prabhukumar *et al.*, 1990).

The improvement achieved in crossbred animals can possible be stabilized against the loss of heterosis over the generation. There is increase or decrease in the performance of crossbreds during different generation. This change in performance may be due to the effect of heterosis, segregation and recombination of genes of non-dominant effect. Thus, there is need to assess the comparative performance of these crossbred animals in different generations (Bhagat *et al.*, 2006).

MATERIAL AND METHODS

The data were collected from the history and pedigree sheets maintained at Research Cum Development Project on Cattle, M.P.K.V., Rahuri, Dist. - Ahmednagar (MS), for the period of 40 years (1972 to 2011) on reproduction traits of Gir halfbreds, triple cross and their *Interse*.

The animals were kept under loose housing system with lofing area and covered sheds. All calves were housed in calf pens up to three months of age and thereafter reared separately in loose housing system according to age group. The feeding and management of the cattle was more or less uniform throughout the year. The maintenance, production and growth ration were given as per feeding standards with green and dry fodders.

The data were collected as follows

I. Pre-partum reproduction traits (days)

1. Age at first service (AFS)
2. Age at first fertile service (AFFS)
3. Age at first calving (AFC)

II. Post- partum reproduction traits (days)

1. Open period (OP)
2. Service period (SP)
3. Calving interval (CI)

The data were classified according to genetic group, season of birth/calving, period of birth/calving and lactation order. The following generations were considered for estimation of least square means for production and reproduction traits.

Genetic group	G_1	G_2	G_3	G_4	G_5	G_6	G_7
50% HF + 50% Gir	FG	IH	3IH	4IH	5IH	6IH	7IH
50% HF +25% J + 25% Gir	FJG	H	3H	4H	5H	6H	7H

As per climatic conditions of the farm the data of each year were divided into three seasons as Rainy, Winter and Summer. The data were divided into different genetic groups according to their period of birth. The parity wise data were collected up to 7th lactation of animal maintained at the farm. In order to overcome non- orthogonality of the data due to unequal subclass frequencies, least squares techniques (Harvey, 1990) was used to estimate the effect of different factors using different models at Department of Statistic, National Dairy Research Institute, (NDRI) Karnal, India.

Effect of genetic and non-genetic factors were estimated by least squares technique suggested by Harvey (1990) using the following model:

a. Model for estimation of effect of non-genetic factors

$$Y_{ijkl} = \mu + A_i + B_j + C_k + e_{ijkl}$$

Where,

Y_{ijkl} = Performance record of i^{th} period of birth/calving of j^{th} season of birth/calving and k^{th} lactation order

μ = Overall mean

A_i = Effect of i^{th} period of birth/calving

B_j = Effect of j^{th} season of birth/calving

C_k = Effect of k^{th} lactation order

e_{ijkl} = Random error NID (0, 62e)

The period of birth effect was estimated only for the age at first calving.

Duncan's Multiple Range Test (DMRT)

Duncan's multiple range test as modified by Kramer (1957) was used to make pair wise comparison among the least squares means with the use of inverse elements and root mean squares of error.

If the values

$$(Yi - Yj) \times \sqrt{\frac{2}{Cii + Cjj - 2Cij > \sigma^2 e,\ Z(P, ne}}$$

Yi – Yj = Difference between the two least square means

Cii = Corresponding i^{th} diagonal elements of C matrix

Cjj = Corresponding j^{th} diagonal elements of C matrix

Z(P,ne) = Standardized range value in Duncan's table at the chosen level of probability for ne the error degrees of freedom

P = Number of means involved in the comparison

$\sigma^2 e$ = Root mean squares of error.

Correction of data

The data on reproduction and production traits were corrected for the significant effects of period and season of birth/calving according to the formula suggested by Gacula *et al.* (1968). The corrected data were used to estimate the effect of genetic group and generation, similarly to estimate genetic parameters *viz.,* genetic correlations, phenotypic correlations and heritability.

b. Model for effect of genetic group and generation

$$Y_{ijk} = \mu + A_i + B_j + e_{ijk}$$

Where,

Y_{ijk} = Performance record of i^{th} genetic group of j^{th} generation

μ = Overall mean

A_i = Effect of i^{th} genetic group

B_j = Effect of j^{th} generation

e_{ijk} = error NID (0, σ^2e)

RESULTS AND DISCUSSION

The data pertaining to FG (551 records), Interse of FG (721 records), FJG (362 records), and *Interse* of FJG (1082 records), from year 1972 to 2011 (40 years) are used for analysis. The overall least squares mean of AFC in FG and FJG were 455.95 ± 6.91 and 496.72 ± 5.08 days while in *Interse* of FG and FJG were 638.99 ± 8.31and 660.31 ± 8.86 days, respectively. Similar results have been reported by Gill (1978) in crossbred of Red Danish x Sahiwal cows and Navale (1991) in Brown Swiss crosses. Kale (1984) and Pyne (1987) was reported short AFS in FG, JG, FH and JH crosses, respectively. The period of birth had significant effect on all genetic groups except FG group. The season of birth had non-significant effect on AFS in all genetic groups. Similar result was reported by Ahuja (1961) in Hariana cattle, Luktuke (1961) in Gir cow, Ranjan (1981) in HF, J and Gir crosses.

The generation had significant ($P<0.01$) effect on AFS. There were significant differences in the generation of FG and FJG group. The overall mean AFS as affected by generation was 628.91 ± 6.09 days in FG and 645.81 ± 5.18 days in FJG. Significantly lowest AFS (days) was observed in the Ist generation cows, however, the highest AFS noticed in cows of VIth generation. The cows from generation IIIrd to Vth and VIIth were performance at par with each other in FJG group. The overall least squares mean of AFFS in FG and FJG was 533.41 ± 6.37 and 538.82 ± 0.37 days, while in *Interse* of FG and FJG was 743.13 ± 10.72 and 760.44 ± 12.61 days, respectively. The overall mean for AFFS in FG and FJG group were 709.61 ± 8.00 and 739.97 ± 7.39 days. The effect of generation was significant in FG and FJG group.The genetic group wise overall mean AFFS was 687.29 ± 5.53 days. The result indicates that FG genetic group had lowest value of AFFS. In connection with this results Nagarcenkar and Rao (1982) reported AFFS in JT was 548.00 and in FO was 549.00, Sharma (1986) in BO, FO and JO were 616.27, 616.27

The overall least square means of AFC in FG and FJG were 820.90 ± 10.03 and 816.86 ± 8.02 days, while in *Interse* of FG and FJG was 1020.87. ± 11.41 and 1038.30 ± 13.38 days, respectively.

Significant effect of generation on AFC in all genetic group of Gir crossbred cow. The overall mean for generation of AFC was 997.26 ± 8.48 days in FG group and 1017.17 ± 7.90 days in FJG group. The overall least squares mean of OP in FG and FJG was 75.94 ± 1.69 and 66.61 ± 3.33 days. However in *Interse* of FG and FJG was 75.13 ± 2.89 and 74.74 ± 5.13 days, respectively. The lower AFC days than the present results were reported by Bhoite (1996) in JG genetic group (792.70 ± 17.08). However, higher values of AFC days were noticed by Thombre *et al.* (2002) in HF x D halfbreds (1308.75 ± 76.44), Bhagat *et al.* (2006) in FG halfbreds (1054.67 ± 12.63) and Jadhav (2011) in FG (834.09 + 12.32), Phule Triveni (818.85 + 7.80), IFG (1040.03 + 10.47) and Interse of Phule Triveni were (1006.10 + 16.09).

The period of calving and season of calving had non-significant effect on service period. Similar results were also reported by Kamble (2003) in Gir crossbreds. Lactation order had non-significant effect on service period in all genetic groups. The effect of generation and genetic group was non-significant on service period in all genetic groups. The overall least squares mean of calving interval in FG and FJG was 413.20 ± 4.89 and 410.02 ± 7.53 days, respectively. However in *Interse* of FG and FJG it was 417.53 ± 4.64 and 427.42 ± 8.77 days, respectively. The present results resembled with Bhoite (1996) in FJG (135.08 ± 9.20 days) and Interse of FJG (145.02 ± 7.26 days) genetic groups and Kamble (2003) in FJG (139.00 ± 3.40 days) groups. Analysis of variance revealed that period of calving and season of calving had non-significant on calving interval in Gir crossbred cows. Lactation order had non-significant effect on calving interval in all genetic groups. Effect of generation had non-significant

Table 1. Least squares means for AFS (days) in FG and FJG group

Sources of variation	*Genetic groups*						
	FG			*Sources of variation*	*FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	130	455.95	6.91	μ	115	496.72	5.08
POB				POB			
1972-1973	44	455.52	11.25	1975-1977	69	482.21[a]	6.65
1974-1975	86	456.38	7.90	1978-1980	46	511.24[b]	7.94
SOB				SOB			
S_1(Jun-Sept)	47	457.13	10.83	S_1(Jun-Sept)	32	490.99	9.41
S_2(Oct-Jan)	47	466.98	10.55	S_2(Oct-Jan)	44	499.14	8.52
S_3(Feb-May)	36	443.74	13.05	S_3(Feb-May)	39	500.03	8.52

Table 2
Generation wise least squares means for AFS (days) in Gir crossbred cow

Sourcesof variation	*Genetic groups*					
	FG			*FJG*		
	N	*Mean*	*S.E.*	*N*	*Mean*	*S.E.*
μ	365	628.91	6.09	486	645.81	5.18
Generation						
G_1	130	457.48[a]	8.43	122	500.23[a]	7.91
G_2	61	675.19[d]	12.31	119	658.16[c]	8.01
G_3	46	620.97[b]	14.18	94	663.34[cd]	9.02
G_4	49	661.18[c]	13.74	68	639.72[b]	10.61
G_5	37	674.91[cd]	15.82	46	671.78[d]	12.89
G_6	27	673.59[cd]	18.51	17	711.41[e]	21.21
G_7	15	639.06[bc]	24.83	20	676.55[d]	19.53

Means in the same column with different superscript differed significantly

Table 3
Least squares means for AFFS (days) in FG and FJG group

Sources of variation	*Genetic groups*			*Sources of variation*	*Genetic groups*		
	FG				*FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	130	533.41	6.37	μ	115	538.82	7.00
POB				POB			
1972-73	44	539.78	16.10	1975-77	69	503.88	9.16
1974-75	86	527.03	11.30	1978-80	46	571.75	10.94
SOB				SOB			
S_1(Jun-Sept)	47	532.33	15.50	S_1(Jun-Sept)	32	526.00	12.97
S_2(Oct-Jan)	49	540.77	15.10	S_2(Oct-Jan)	44	545.44	11.74
S_3(Feb-May)	34	527.11	18.67	S_3(Feb-May)	39	545.02	11.74

Table 4
Least squares means for AFFS (days) in Interse of FG and FJG group

Sources of variation	*Genetic groups Interse of FG* N	Mean	S.E.	*Sources of variation*	*Genetic groups Interse of FJG* N	Mean	S.E.
μ	235	743.13	10.72	μ	364	760.44	12.61
POB							
1980-1985	64	666.71[a]	17.70	1977-1982	93	654.89[b]	14.38
1986-1991	50	692.39[b]	20.24	1983-1988	108	604.01[a]	13.38
1992-1997	68	810.84[c]	17.15	1989-1994	109	691.26[c]	13.27
1998-2003	38	845.02[d]	23.06	1995-2000	37	865.43[e]	22.77
2004-2009	15	700.71[b]	36.68	2001-2006	10	956.00[f]	43.08
2010 - onward	—	—	—	2007-2011	7	791.06[d]	52.32
SOB							
S_1(Jun-Sept)	78	743.74	17.31	S_1(Jun-Sept)	106	752.37	16.79
S_2(Oct-Jan)	77	740.18	17.43	S_2(Oct-Jan)	141	882.95	15.96
S_3(Feb-May)	80	745.48	16.34	S_3(Feb-May)	117	746.00	16.19

Means under each class in the same column with different superscript differed significantly

Table 5
Generation wise least squares means for AFFS (days) in Gir crossbred cow

Sourcesof variation	*Genetic groups*					
	FG			*FJG*		
	N	*Mean*	*S.E.*	*N*	*Mean*	*S.E.*
μ	365	709.61	8.00	486	739.97	7.39
Generation						
G_1	130	532.09[a]	11.06	122	541.53[a]	11.28
G_2	61	776.95[e]	16.15	119	743.68[b]	11.42
G_3	46	686.43[b]	18.60	94	769.40[cd]	12.85
G_4	49	759.32[d]	18.02	68	754.60[c]	15.11
G_5	37	739.37[c]	20.74	46	778.71[d]	18.37
G_6	27	747.40[cd]	24.28	17	798.24[e]	30.22
G_7	15	725.73[c]	32.58	20	793.65[e]	27.86

Means in the same column with different superscript differed significantly

Table 6
Least squares means for AFC (days) in FG and FJG group

Sources of variation	*Genetic groups FG*			*Sources of variation*	*Genetic groups FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	130	820.98	10.03	μ	115	816.86	8.02
POB				POB			
1972-73	44	839.15[b]	16.33	1975-77	69	781.99[a]	10.49
1974-75	86	802.82[a]	11.46	1978-80	46	851.72[b]	12.53
SOB				SOB			
S_1(Jun-Sept)	47	824.51	15.73	S_1(Jun-Sept)	32	803.60	14.85
S_2(Oct-Jan)	49	828.48	15.33	S_2(Oct-Jan)	44	825.06	13.45
S_3(Feb-May)	34	809.96	18.95	S_3(Feb-May)	39	821.91	13.45

Means under each class in the same column with different superscript differed significantly

Table 7
Least squares means for AFC (days) in Interse of FG and FJG group

Sources of variation	*Genetic groups Interse of FG*			*Sources of variation*	*Genetic groups Interse of FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	235	1028.87	11.41	μ	364	1038.30	13.38
POB							
1980-1985	64	957.28[a]	18.84	1977-1982	93	939.94[b]	15.25
1986-1991	50	994.26[b]	21.54	1983-1988	108	876.96[a]	14.19
1992-1997	68	1082.55[c]	18.25	1989-1994	109	979.02[c]	14.07
1998-2003	38	1143.28[d]	24.52	1995-2000	37	1140.13[e]	24.15
2004-2009	15	966.98[ab]	39.03	2001-2006	10	1224.09[f]	46.45
2010-onward	—	—	—	2007-2011	7	1069.68[d]	55.49
SOB							
S_1(Jun-Sept)	78	1012.37	18.42	S_1(Jun-Sept)	106	1040.10	17.81
S_2(Oct-Jan)	77	1039.41	18.54	S_2(Oct-Jan)	141	1055.29	16.93
S_3(Feb-May)	80	1034.82	17.39	S_3(Feb-May)	117	1019.52	17.17

Means under each class in the same column with different superscript differed significantly

Table 9
Generation wise least squares means for AFC (days) in Gir crossbred cow

Sources of variation	*Genetic groups*					
	FG			*FJG*		
	N	*Mean*	*S.E.*	*N*	*Mean*	*S.E.*
μ	365	997.26	8.48	486	1017.17	7.90
Generation						
G_1	130	822.15^{a}	11.73	122	820.03^{a}	12.06
G_2	61	1059.54^{d}	17.13	119	1021.59^{b}	12.21
G_3	46	977.54^{b}	19.79	94	1044.24^{c}	13.74
G_4	49	1032.49^{c}	19.12	68	1030.53^{b}	16.15
G_5	37	1032.05^{c}	22.00	46	1060.45^{d}	19.64
G_6	27	1049.59^{d}	25.78	17	1075.99^{d}	32.31
G_7	15	1007.47^{c}	34.55	20	1067.35^{d}	29.79

Means in the same column with different superscript differed significantly

Table 10
Least squares means for open period (days) in FG and FJG group

Sources of variation	*Genetic Groups*			*Sources of variation*	*Genetic Groups*		
		FG				*FJG*	
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	441	75.94	1.69	μ	282	66.61	3.33
POC				POC			
1974-1979	274	80.50	2.51	1977-1982	219	74.45	5.27
1980-1985	167	71.41	2.36	1983-1988	63	58.77	5.23
SOC				SOC			
S_1(Jun-Sept)	126	73.38	2.80	S_1(Jun-Sept)	96	69.69	4.55
S_2(Oct-Jan)	163	77.60	2.59	S_2(Oct-Jan)	90	60.45	4.89
S_3(Feb-May)	152	76.88	2.54	S_3(Feb-May)	96	69.68	4.77
LO				LO			
L_1	127	74.75	3.07	L_1	119	76.52	5.41
L_2	117	77.42	2.79	L_2	55	68.41	6.31
L_3	84	70.27	3.27	L_3	43	71.32	6.51
L_4	54	74.55	4.05	L_4	28	72.26	7.53
L_5	35	79.87	5.11	L_5	18	55.56	9.63
L_6	24	78.87	6.30	L_6	10	71.48	12.44
L_7	-	-		L_7	9	50.70	13.85

Means under each class in the same column with different superscript differed significantly

Table 11
Generation wise least squares means for open period (days) in Gir crossbred cow

Source of variation	*Genetic groups*					
	FG			*FJG*		
	N	*Mean*	*S.E.*	*N*	*Mean*	*S.E.*
µ	1018	76.88	1.63	1053	79.07	2.30
Generation						
G_1	441	76.51	1.78	282	75.85	2.64
G_2	134	70.85	3.24	293	79.80	2.59
G_3	125	76.40	3.36	216	69.64	3.01
G_4	144	70.42	3.13	117	84.23	4.09
G_5	90	82.63	3.96	106	74.97	4.30
G_6	59	81.97	4.88	20	93.10	9.91
G_7	25	79.40	7.50	19	75.89	10.16

Table 12
Least squares means for service period (days) in FG and FJG group

Sources of variation	*Genetic Groups*			*Sources of variation*	*Genetic Groups*		
		FG				*FJG*	
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
µ	441	141.67	4.81	µ	282	133.85	7.01
POC				POC			
1974-1979	274	140.51	7.11	1977-1982	219	136.03	11.08
1980-1985	167	142.82	6.68	1983-1988	63	131.68	10.99
SOC				SOC			
S_1(Jun-Sept)	126	141.87	7.94	S_1(Jun-Sept)	96	128.38	9.56
S_2(Oct-Jan)	163	135.32	7.33	S_2(Oct-Jan)	90	139.47	10.28
S_3(Feb-May)	152	147.82	7.20	S_3(Feb-May)	96	133.71	10.03
LO				LO			
L_1	127	136.94	8.69	L_1	119	145.02	11.36
L_2	117	134.49	7.92	L_2	55	140.34	13.26
L_3	84	134.26	9.27	L_3	42	136.80	13.69
L_4	54	158.91	11.49	L_4	28	120.65	15.82
L_5	35	158.14	14.47	L_5	18	117.99	20.24
L_6	24	127.26	17.86	L_6	11	136.32	26.19
L_7	-	-	-	L_7	9	139.85	29.12

Table 13
Least squares means for service period (days) in Interse of FG and FJG group

Source of variation	*Genetic groups Interse of FG*			*Sourceof variation*	*Genetic groups Interse of FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	584	138.65	4.76	μ	782	150.11	8.83
POC				POC			
1982-1987	97	132.23	8.74	1979-1984	118	141.75	10.55
1988-1993	121	135.43	7.70	1985-1990	289	134.65	7.48
1994-1999	192	149.56	6.00	1991-1996	217	149.93	8.35
2000-2005	120	142.41	7.20	1997-2002	130	145.70	9.26
2006-2011	54	133.57	10.07	2003-2007	20	193.23	20.63
				2008=2011	8	135.41	31.81
SOC				SOC			
S_1(Jun-Sep)	**182**	129.94	6.46	S_1(Jun-Sep)	237	146.13	9.93
S_2(Oct-Jan)	193	143.57	6.24	S_2(Oct-Jan)	313	151.98	9.70
S_3(Feb-May)	207	142.42	6.37	S_3(Feb-May)	232	152.22	10.12
LO				LO			
L_1	**239**	140.09	4.76	L_1	313	165.82	7.52
L_2	134	143.26	6.38	L_2	190	157.23	8.58
L_3	83	136.54	7.97	L_3	131	154.14	9.52
L_4	57	139.19	9.63	L_4	86	157.44	11.39
L_5	36	153.56	12.06	L_5	40	146.27	15.31
L_6	23	119.47	15.11	L_6	15	138.22	23.64
L_7	12	138.41	20.74	L_7	7	131.66	33.88

Table 14
Least squares means for calving interval (days) in FG and FJG group

Sources of variation	*Genetic groups FG*			*Sources of variation*	*Genetic groups FJG*		
	N	*Mean*	*S. E.*		*N*	*Mean*	*S.E.*
μ	518	413.20	4.89	μ	285	410.02	7.53
POC				POC			
1974-1979	301	411.09	7.41	1977-1982	222	409.78	11.66
1980-1985	217	419.31	6.18	1983-1988	63	410.26	11.89
SOC				SOC			
S_1(Jun-Sep)	157	405.93	7.51	S_1(Jun-Sep)	93	405.26	10.47
S_2(Oct-Jan)	189	407.34	7.35	S_2(Oct-Jan)	94	409.79	10.98
S_3(Feb-May)	172	432.33	7.23	S_3(Feb-May)	98	415.02	10.73
LO				LO			
L_1	126	413.55	8.90	L_1	117	426.31	12.23
L_2	126	416.34	7.94	L_2	57	419.32	14.15
L_3	100	419.61	8.87	L_3	42	416.20	14.81
L_4	71	431.70	10.45	L_4	30	397.68	16.57
L_5	46	428.24	13.21	L_5	19	393.92	21.23
L_6	30	394.93	16.68	L_6	11	397.12	28.34
L_7	19	402.03	20.71	L_7	9	419.39	31.53

Table 15
Least squares means for calving interval (days) in *Interse* of FG and FJG group

Source of variation	*Genetic groups Interse of FG*			*Source of variation*	*Genetic groups Interse of FJG*		
	N	*Mean*	*S.E.*		*N*	*Mean*	*S.E.*
μ	694	417.53	4.64	μ	776	427.42	8.77
POC				POC			
1982-1987	101	416.85	9.63	1979-1984	104	420.13	10.92
1988-1993	151	416.20	7.69	1985-1990	288	415.52	7.38
1994-1999	215	429.84	6.35	1991-1996	220	423.31	8.26
2000-2005	152	423.63	7.23	1997-2002	136	425.43	9.07
2006-2011	75	401.11	9.89	2003-2007	20	473.39	20.58
				2008-2011	8	406.75	31.78
SOC				SOC			
S_1(Jun-Sep)	218	409.32	6.51	S_1(Jun-Sep)	233	426.39	9.89
S_2(Oct-Jan)	229	422.15	6.45	S_2(Oct-Jan)	313	428.56	9.67
S_3(Feb-May)	247	421.11	6.44	S_3(Feb-May)	230	427.31	10.06
LO				LO			
L_1	234	421.63	5.59	L_1	303	441.36	7.54
L_2	166	416.53	6.58	L_2	194	437.18	8.54
L_3	116	414.08	7.90	L_3	129	431.25	9.57
L_4	74	410.77	9.85	L_4	86	435.01	11.41
L_5	51	430.89	11.90	L_5	40	426.39	15.31
L_6	35	409.23	14.30	L_6	17	408.65	22.31
L_7	18	419.33	19.79	L_7	7	412.13	33.87

effect on calving interval in FG group and significant ($P<0.05$) effect in FJG group. In FJG group the significantly lowest CI was noticed in cows of Ist generation and significantly highest CI had been noticed in VIth generation. The cows of IInd and IIIrd generation performance was at par, similarly, the cows of IVth and Vth generation performance was at par with each other. The effect of genetic group was non-significant on calving interval in all genetic groups. The results were in consonance with Bhoite (1996) in Gir halfbred and triple crosses, Kanawade (1997) and Bhagat *et al.* (2006) in Gir crossbred cows and Jadhav (2011) in Gir crossbred.

CONCLUSION

1. Most of the reproduction traits under study were affected by non-genetic factors indicating the importance of feeding and management for enhancing performance.
2. The first generation of FG and FJG showed significantly higher performance over their *Interse* because of hybrid vigor, subsequent decline in further generations in FG and FJG indicated to restrict the *Interse* mating.

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